

REMARKS

Summary

Claims 1-9 were pending and all of the claims were rejected in the Office action; Claims 1 and 9 have been amended. Claims 1-9 remain pending after entry of this amendment. The Applicant has carefully considered the references and reasons advanced by the Examiner, and respectfully traverses the rejections in view of the amendments and the discussion presented below.

Claim Rejections

35 U.S.C. § 103 (a)

Claims 1, 7 and 8 were rejected under 35 U.S.C. § 103 (a) as unpatentable over Lin (US 6,074, 767; "Lin") in view of Gill et al. (US 5,508,866; "Gill"). Claim 1 has been amended to incorporate subject matter previously in Claim 9 in order to further clarify the details of the structure. The Applicant submits that the Examiner has not made out a *prima facie* case of obviousness, without regard to the effect of the amendment.

Claim 1 recites, *inter alia*, a spin-valve magnetoresistive sensor comprising soft magnetic layers that are arranged on said free magnetic layer having a spacing between said soft magnetic layers corresponding to a track width defined at a level at which said soft magnetic layers fill recesses in the free magnetic layer wherein a thickness of said soft magnetic layers exceeds a depth of the recesses.

The Examiner notes that Lin fails to disclose the limitation "wherein a thickness of said soft magnetic layers exceeds a depth of the recesses, but that Gill "provide[s] evidence that the thickness of the soft magnetic 'seed layers' can exceed the depth of the recess...", citing Fig. 7, layers 74 and column 7 line 37 bridging column 8, line 14). However, Fig. 7 (Gill) is ambiguous, as the height of the left-hand-side layer 74 is greater than that of the right-hand-side layer, and

nothing in the specification resolves the ambiguity. It is well settled that an anticipation rejection cannot be predicated on an ambiguous reference (*In re Turlay*, 304 F.2d 893, 899 134 USPQ 355, 360 (CCPA 1962)). By extension, an ambiguous teaching cannot be used as a reference to make out a case of obviousness. Gill provides no guidance as to the thickness of the "seed layer" layer 74 except that it is "thin" (Gill, column 7, line 67). Gill does not teach or suggest that there is any property of the seed layer, such as the thickness that should be optimized, nor the objective of any optimization. As noted later in this paper, the area on which the seed layer is deposited is exposed by ion milling and there is no suggestion that a recess is necessarily formed.

In the specification (column 7, lines 61-67), Gill describes the fabrication of the structure shown in Fig. 7, in part, as "the sensor end region 76 is defined by photolithography and subtractively processed, such as by ion milling or etching, for example, to remove the thin Ta cap layer to expose the NiFe MR layer at the end regions. The longitudinal bias layer 77 is deposited in the sensor end regions 76 in physical contact with the MR layer 75 over a thin seed layer 74 of NiFe...." Nothing in the written description teaches or suggests that a recess is formed in the free magnetic layer 75. As such, this situation is equivalent to the Examiner's previous citation of Rottmeyer et al. (US 6,201,673; Rottmeyer). In the Office action, at page 8, the Examiner acknowledges that Rottmeyer does not teach the formation of recesses in the free magnetic layer except in an incidental and uncontrolled fashion, and the same argument is made here; Gill does not teach the formation of recesses, only that the cap layer is removed by a process such as ion milling or etching. Hence the formation of a recess of controlled depth is not taught by Gil, the cited references do not teach or suggest all of the elements and limitations of Claim 1, and therefore there is no showing of a *prima facie* case of obviousness.

A "seed layer" is normally used either to promote the adhesion of an upper layer to a lower layer, or to influence the crystalline structure of the layer to be

subsequently deposited on top of it. Nothing in Gill teaches or suggests that the thickness of the "seed layer" 74 is related to the formation of a single magnetic domain in the free magnetic layer 75, and Gill does not suggest that the seed layer should have any characteristic except being "thin."

Thickness of the soft magnetic layer which fills the recess in the arrangement of Claim 1 should be controlled. For example, if the soft magnetic layer is too thick, the longitudinal bias is too susceptible to the external magnetic field, which causes the reproduced waveform to become unstable. However, if the soft magnetic layer is too thin, deterioration occurs to the exchange-coupled magnetic field between the bias layer and the soft magnetic layer as, for example, the soft magnetic layer cannot maintain satisfactory integrity of crystallinity. By providing the recesses as well as a soft magnetic layer whose thickness is larger than that of the recesses, the thickness of the free and soft magnetic layer combination does not increase proportionally as much as that of the soft magnetic layer. As a result, the longitudinal bias problem above is prevented while simultaneously avoiding deterioration of the exchange-coupled magnetic field between the bias layer and the soft magnetic layer. Thus the arrangement of Claim 1 results in improvement of the reproduction sensitivity, track width controllability, and stability of the reproduced waveform.

The Examiner asserts "that the thickness of the soft magnetic 'seed layers' can be varied to effect the exchange coupling interaction between the AFM bias layers (Lin, "AFM2" layers) and the free layer (Lin, layer 36) in a magnetic sensor, since the coupling force depends on the relative 'closeness' of the two layers." There is no support for the association of the "seed layer" with the function of the soft magnetic layer recited in Claim 1 nor an explanation of the meaning of "closeness" in the Office action. As set forth, this is an unsubstantiated statement apparently made on the basis on knowledge of the Examiner, and the Applicant respectfully requests that the Examiner provide appropriate substantiation for the assertions.

Any motivation to modify the prior art references must flow from some teaching in the art that suggests the desirability or incentive to make the modification needed to arrive at the claimed invention. *In re Napier*, 55 F.3d 610, 613, 34 USPQ2d 1782, 1784 (Fed Cir. 1995); *In re Gorman*, 933 F.2d 982, 986-87, 18 USPQ2d 1885, 1888, (Fed. Cir. 1991). ("When it is necessary to select elements of various teachings in order to form the claimed invention, we ascertain whether there is any suggestion or motivation in the prior art to make the selection made by the applicant. [Citations omitted] . . . The extent to which such suggestion must be explicit in, or may be fairly inferred from, the references, is decided on the facts of each case in the light of the prior art and its relationship to the applicants' invention.").

Neither of the two references, either alone or in combination discloses or teaches all of the elements of Claim 1, nor is there any suggestion in either reference to combine the teachings as set forth therein, and therefore a *prima facie* case of obviousness has not been made out.

Where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation. *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955)(citing *In re Swain*, 156 F.2d 239, 70 USPQ 412 (CCPA 1946); *Minnesota Mining and Mfg. Co. v. Coe*, 99 F.2d 986, 38 USPQ 213 (D.C. Cir. 1938); *Allen v. Coe*, 135 F.2d 11, 57 USPQ 136 (D.C. Cir. 1943)). As with many rules, however, there are exceptions to the CCPA's rule such as where a "parameter optimized was not recognized to be a result-effective variable" *In re Antonie*, 559 F.2d 618, 621, 195 USPQ 6, 8 (CCPA 1977).

The Examiner deemed that it "would have been obvious to one having ordinary skill in the art to determine an optimal relative thickness of the soft magnetic 'seed layer' by optimizing the results effective variable through routine

experimentation.” The Applicant respectfully traverses this assertion, as the functions of the soft magnetic layer in the arrangement of Claim 1 and that of the “seed layer” disclosed in Gill are different, and that only in view of the Applicant’s disclosure would the optimization of the soft magnetic layer thickness to manage the magnetization strength in the free magnetic layer be a design consideration. Gill provides no suggestion that such optimization of the “seed layer” would be useful, and Lin does not teach a “seed layer” at all. Absent a motivation, which alone is provided in the Applicant’s disclosure, optimization of the thickness of the soft magnetic layer for controlling the magnetization of the free magnetic layer would not be a design consideration. Thus the “routine experimentation” would have no objective, and could not yield the result taught by the Applicant.

The Examiner further suggests that the limitation “having a spacing between said soft magnetic layers corresponding to a track width defined at a level at which said soft magnetic layers fill recesses in the free magnetic layer” is a functional limitation. The Applicant contends that it is a proper structural limitation. That is, the spacing between the soft magnetic layers, at the level of the soft magnetic layers, is equal to the dimension called “track width”. Since this constitutes an explicit structural limitation the burden is on the Examiner to demonstrate that the limitation is present in a cited reference. The Applicant respectfully submits that this has not been done.

In addition, Claim 9 has been amended to delete certain subject matter which is now incorporated in Claim 1, the relevant portion of which reads, “a free magnetic layer is divided into a first free magnetic layer disposed farther away from the pinned magnetic layer and a second free magnetic layer disposed closer to the pinned magnetic layer, a non-magnetic intermediate layer is interposed between the first free magnetic layer and the second free magnetic layer, and recesses are formed in the first free magnetic layer ...”

Neither Gill nor Lin recite this limitation, particularly with respect to the recesses being formed in the first free magnetic layer. Since this limitation is not taught or suggested by the references, Claim 1 is allowable.

For at least the reasons set forth above, Claim 1 is allowable.

Claims 2-9, being dependent on and further limiting Claim 1 are, without more, allowable.

The Applicant respectfully submits that the claims as now presented are not obvious in light of the references cited and are in condition for allowance.

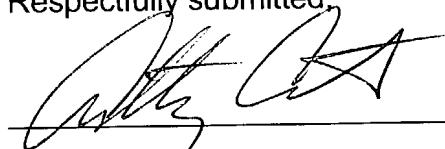
Conclusion

Claims 1-9 remain pending.

For at least the reasons given above, the Applicant respectfully submits that the pending claims are allowable.

The Examiner is respectfully requested to contact the undersigned in the event that a telephone interview would expedite consideration of the application.

Respectfully submitted,

A handwritten signature in black ink, appearing to read 'Anthony P. Curtis', is written over a horizontal line.

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